DEFENSE ADVANCED RESEARCH PROJECTS AGENCY
Submission of Proposals

DARPA's charter is to help maintain U.S. technological superiority over, and to prevent technological surprise by, its potential adversaries. Thus, the DARPA goal is to pursue as many highly imaginative and innovative research ideas and concepts with potential military and dual-use applicability as the budget and other factors will allow.

DARPA has identified 6 technical topics, numbered DARPA SB981-001 through DARPA SB981-006, to which small businesses may respond in the first fiscal year (FY) 98 solicitation (98.1). Please note that these topics are UNCLASSIFIED and only UNCLASSIFIED proposals will be entertained. These are the only topics for which proposals will be accepted at this time. A list of the topics currently eligible for proposal submission is included, followed by full topic descriptions. The topics originated from DARPA technical offices.

Please note that 5 copies of each proposal must be mailed or hand-carried; DARPA will not accept proposal submissions by electronic facsimile (fax). A checklist has been prepared to assist small business activities in responding to DARPA topics. Please use this checklist prior to mailing or hand-carrying your proposal(s) to DARPA. Do not include the checklist with your proposal.

It is expected that the majority of DARPA Phase I awards will be Firm Fixed Price contracts. Phase I proposals shall not exceed $99,000. DARPA Phase II proposals must be invited by the respective Phase I technical monitor (with the exception of projects that qualify for the Fast Track - see Section 4.5). DARPA Phase II proposals must be structured as follows: the first 10-12 months (base effort) should be approximately $375,000; the second 10-12 months (optional effort) should also be approximately $375,000. The entire Phase II effort should not exceed $750,000. It is expected that a majority of the Phase II proposals will be Firm Fixed Price-Level of Effort.

The responsibility for implementing DARPA's SBIR Program rests with the Office of Administration and Small Business (OASB). The DARPA SBIR Program Manager is Ms. Connie Jacobs. DARPA invites the small business community to send proposals directly to DARPA at the following address:
DARPA/OASB/SBIR
Attention: Ms. Connie Jacobs
3701 North Fairfax Drive
Arlington, VA 22203-1714

(703) 526-4170
Home Page http://www.darpa.mil

SBIR proposals will be processed by DARPA OASB and distributed to the appropriate technical office for evaluation and action.

DARPA selects proposals for funding based on technical merit and the evaluation criteria contained in this solicitation document. DARPA gives evaluation criterion a., "The

soundness and technical merit of the proposed approach and its incremental progress toward topic or subtopic solution" (refer to section 4.2 Evaluation Criteria - Phase I - page 7), twice the weight of the other two evaluation criteria. As funding is limited, DARPA reserves the right to select and fund only those proposals considered to be superior in overall technical quality and highly relevant to the DARPA mission. As a result, DARPA may fund more than one proposal in a specific topic area if the technical quality of the proposal(s) is deemed superior, or it may fund no proposals in a topic area. Each proposal submitted to DARPA must have a topic number and must be responsive to only one topic.

In order to ensure an expeditious award, cost proposals will be considered to be binding for a period of 180 days from the closing date of this solicitation. For contractual purposes, proposals submitted to DARPA should include a statement of work which does not contain proprietary information. Successful offerors will be expected to begin work no later than 30 days after contract award. For planning purposes, the contract award process is normally completed within 30 to 60 days from issuance of the selection notification letter to Phase I offerors.

On a pilot basis, the DoD SBIR program has implemented a streamlined Fast Track process for SBIR projects that attract matching cash from an outside investor for the Phase II SBIR effort, as well as for the interim effort between Phases I and II. Refer to Section 4.5 for Fast Track instructions. DARPA encourages Fast Track Applications between the 5th and 6th month of the Phase I effort. Technical dialogue with DARPA Program Managers is encouraged to ensure research continuity during the interim period and Phase II. If a Phase II contract is awarded under the Fast Track program, the amount of the interim funding will be deducted from the Phase II award amount. It is expected that interim funding will not exceed $40,000.

DARPA 1998 Phase I SBIR
Checklist

1) Proposal Format

a. Cover Sheet - Appendix A (identify topic number) _____

b. Project Summary - Appendix B _____

c. Identification and Significance of Problem or Opportunity _____

d. Phase I Technical Objectives _____

e. Phase I Work Plan _____

f. Related Work _____

g. Relationship with Future Research and/or Development _____

h. Commercialization Strategy _____

i. Key Personnel, Resumes _____

j. Facilities/Equipment _____

k. Consultant _____

l. Prior, Current, or Pending Support _____

m. Cost Proposal (see Appendix C of this Solicitation) _____

n. Company Commercialization Report - Appendix E _____

2) Bindings

a. Staple proposals in upper left-hand corner. _____

b. Do not use a cover. _____

c. Do not use special bindings. _____

3) Page Limitation

a. Total for each proposal is 25 pages inclusive of cost proposal and resumes. _____

b. Beyond the 25 page limit do not send appendices, attachments and/or additional references. _____

c. Company Commercialization Report (Appendix E) is not included in the page count. _____

4) Submission Requirement for Each Proposal

a. Original proposal, including signed Appendices A and B. _____

b. Four photocopies of original proposal, including signed Appendices A ,B and E. _____

INDEX OF DARPA FY98.1 TOPICS

Products

DARPA SB981-004 Three-Dimensional Matrices for Cellular and Multicellular Biointerfaces

DARPA SB981-005 Lifting Vehicle for Forward-Deployed Combat Units

DARPA SB981-006 Lightweight, Low-Cost Imaging Sensor System

SUBJECT/WORD INDEX TO THE DARPA FY98.1 TOPICS

Security 6
Sensor 6
Shallow Water Signal Processing 1
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Surf Zone 1
Surveillance 5, 6

Transport Processes 4

Unmanned Vehicle 1

DARPA 98.1 TOPIC DESCRIPTIONS

DARPA SB981-001 TITLE: Littoral Warfare Mine Hunting and Mapping

CRITICAL TECHNOLOGY AREA: Sensors

OBJECTIVE: Develop and demonstrate a prototype mine hunting and mapping system to effectively detect, classify, and map mines and other obstacles in very shallow water and the surf zone. The proposed system should include a suite of sensors and the associated necessary signal processing to perform the detection, classification, and mapping tasks. It should interface with an unmanned platform/vehicle for needed mobility.

DESCRIPTION: To ensure effective safe operations in the littoral, a remote assessment of the mine threat in very shallow water and the surf zone is required. This will permit operational vessels to safely approach hostile shore areas to support a successful attack/landing. This operating environment is very complex and includes colloid suspensions in the water column, bubbles, and water movement caused by the surf. Both the sensor suite and its associated platform can be adversely affected by this unfriendly environment. DARPA, through this SBIR topic, seeks proposals to identify a prototype system that will address this problem in its totality. A successful submission will consider both the sensor suite with appropriate signal processing and the unmanned vehicle to provide safe standoff of the associated supported vessels. A conventional towed behind device tethered to a blue water vessel is not desired. The system should provide a safe channel that is 50 meters wide, and progress at a minimum SOA of 2 km/hr with all mines and minelike objects identified, and accurate positions given, to provide a safe lane in which ships can perform their assigned missions. The unmanned platform can be free swimming, bottom crawling, or other appropriate transporter, preferably autonomously or remotely operated. Sensor suites can be acoustic, nonacoustic, or a combination thereof at the discretion of the proposer. For demonstration purposes, real-time embedded computing for signal processing need not be addressed, but platform guidance and control will.
PHASE I: Using an existing database, model the performance effectiveness of the proposed vehicle and sensor suite and supporting detection, classification, and mapping

algorithms. Demonstrate through modeling/simulation the capability of the unmanned platform to successfully operate in the unfavorable environment.
PHASE II: Construct a prototype system and demonstrate its sensor suite and signal processing capabilities and the platform's shallow water and surf zone maneuverability and suitability.

PHASE III DUAL USE APPLICATIONS: The technologies associated with high resolution mine mapping also provide a capability to produce a high resolution image of the ocean floor. Such imagery would be useful for fisheries studies, sea floor pipeline locating, salvaging operations, and in certain environmental cleanup efforts.

DARPA SB981-002 TITLE: Free-Flight Demonstration of Hypersonic Air-Breathing Supersonic Combustion Ramjet (SCRAM) Propulsion

CRITICAL TECHNOLOGY AREA: Aerospace Propulsion and Power

OBJECTIVE: Develop a low-cost, near term demonstration of sustained air-breathing flight at Mach ? 6 and obtain flight environment data for validation of simulations of the flight conditions.

DESCRIPTION: The program should comprise the design, fabrication, and testing of flight articles and related diagnostics. The design and data analysis activities will be conducted in cooperation with government agencies as directed by the sponsor. Maximum use of commercially available "off-the-shelf" hardware and economical manufacturing techniques should be employed. This program is expected to lead to the advancement of technology for production of a high speed, affordable, stand-off missile and, ultimately, to a manned hypersonic transport for commercial and military use.
PHASE I: This phase encompasses the design and critical component testing of a gun-launched scram projectile and associated on-board diagnostics. The projectile and payload will be designed to survive launch loads in excess of 20 kg and to demonstrate thrust ? drag at Mach and Reynolds number appropriate to an operational free flight (80Kft, Mach ? 6) demonstration. The miniature on-board instrumentation will provide 10 data channels, including acceleration, pressure, and temperature. The program plan should include two trips to the managing program office and identification of potential flight test facilities.
PHASE II: This phase involves manufacture and free-flight testing of the Phase I design. Five flight articles will be fabricated and tested at an appropriate hypervelocity launch facility. Critical demonstrations include mechanical integrity, stable free-flight, inlet start, fuel release and ignition, and flight data acquisition.

PHASE III DUAL USE APPLICATIONS: The development and demonstration of an air-breathing hypersonic engine will lead to commercial applications such as civil hypersonic transport and space launch. This air-breathing propulsion technology is critical to high speed bomber and transport

propulsion systems.

DARPA SB981-003 TITLE: Collaborative Engineering Decision Support for Distributed Design of Complex Electro-Mechanical Products

CRITICAL TECHNOLOGY AREA: Manufacturing Science and Technology (MS&T)

OBJECTIVE: Define, design, and demonstrate an Engineering Decision Support (EDS) computer tool to support multi-disciplinary, distributed design teams through the decision making process.

DESCRIPTION: Design of complex electro-mechanical products is comprised of an evolution of information which begins with an incomplete definition of need for such products, and ends with exact specifications for the product's manufacture, operational use, and disposal. In the development of this information, key decisions are made which define the product evolution and ultimately determine the product's acceptance by the customer. Current design systems are limited in guiding multi-disciplinary teams through the decision making process. Also lacking are automated capabilities which can exploit methods such as Quality Function Deployment (QFD) and Design of Experiments (DOE).
This topic seeks to extend current capabilities to: a) support the capture of customer requirements; b) provide methods to map requirements to engineering specifications; c) enable capture of design rationale and support the integration of results from analytical evaluation or experiments into the design rationale; d) support multi-disciplinary design teams in coming to consensus; e) support the recovery of design rationale by providing mechanisms for organizing, sorting, retrieving, and communicating to a product database; and f) support distributed teams through the use of the internet.
PHASE I: Define the architecture and key components of the EDS tool to support the topic objective.
PHASE II: Prototype and demonstrate the EDS tool defined in Phase I by exercising its functionality through the use of a complex electro-mechanical product design scenario.

PHASE III DUAL USE APPLICATIONS: The availability of a design tool that structures and captures design information while assisting design teams in making decisions and directing them toward their next decision would be attractive to both defense and commercial sectors.

DARPA SB981-004 TITLE: Three-Dimensional Matrices for Cellular and Multicellular Biointerfaces

CRITICAL TECHNOLOGY AREA: Materials, Processes and Structures

OBJECTIVE: Creation of three-dimensional environments for the controlled spatial orientation enabling efficient transport, supporting metabolism and differentiation and

long-term stability of biological cells.

DESCRIPTION: Research and development leading to the fabrication of three-dimensional materials that support the function of cellular and multicellular biological components. Efforts may address any class of materials that is compatible with biological function including hydrogels, silicones, ceramics, or plastics and may address modification of existing materials or design and synthesis of new materials. Development areas of interest include efficient bioreactor designs, materials that support adhesion, growth and differentiation of biological cells including stem cells, neurons, endothelial cells, and monocytes.
PHASE I: In detail, define the material and the cell type application, the approach to demonstration of biocompatibility and cellular performance and the expected benefits of the material.
PHASE II: Fabricate material and cell constructs that demonstrate long-term multicellular function. Optimize the material properties to include transport of nutrients and wastes within the matrix and the processing of information from the detection and response to chemical and biological agents. Limitations of the system with regard to dimensionality of the matrix and constraints to cellular function must be defined. Complete documentation of test cases and results must be delivered.

PHASE III DUAL USE APPLICATIONS: The development of a three-dimensional matrix for the spatial orientation of biological cells will expand the commercial market for multicellular based biosensors and bioreactors for the efficient production of terminally differentiated cells or other biological products of cells. Dramatic improvement in biocompatibility of materials and improved cellular function will be enabled by defining and fabricating new three-dimensional materials.

DARPA SB981-005 TITLE: Lifting Vehicle for Forward-Deployed Combat Units

CRITICAL TECHNOLOGY AREA: Surface/Under Surface Vehicles/Ground Vehicles

OBJECTIVE: Provide a means for forward-deployed troops to elevate a sensor for local area surveillance and other missions.

DESCRIPTION: A system for elevating a 5-25 pound payload up to 300ft above ground level is needed to support forward-deployed combat units. The technology sought is the lift system, the deployment system, and the control system. Fixed-wing, rotary-wing, and lighter-than-air systems may be considered. Automatic station-keeping and greater than 2 hours time-on-station are required. The payloads of interest would provide situational awareness, Combat ID, IFF, and communications relay for forward area troops.
PHASE I: Design a prototype lifting body/structure and its transportation, deployment, and stowage systems. Predict lift altitude/payload weight capacity, size/weight/power

requirements, and deployment/stowage times. Perform hardware risk reduction for critical technologies.
PHASE II: Build a prototype of the system with support equipment required for a demonstration deployment of a dummy payload. Exercise the lift weight/altitude performance profile and time-on-station capability. Report on production considerations and lessons learned from the prototype.

PHASE III DUAL USE APPLICATIONS: Commercial surveillance and security operations as well as law enforcement and emergency rescue agencies have a need for lifting bodies capable of elevating short-range sensors. Additionally, national border and coastal surveillance agencies could significantly enhance their missions through such a system.

DARPA SB981-006 TITLE: Lightweight Imaging Sensor System

CRITICAL TECHNOLOGY AREA: Sensors

OBJECTIVE: Design, develop and demonstrate an all weather, lightweight, low-cost, distributed-component sensor suite suitable for deployment on a small, lighter-than-air, stationary airborne platform.

DESCRIPTION: Lightweight imaging sensors, which have remote signal processing, displays and controls for use by forward-deployed combat units and overseas garrison security forces are required for integration on small, mobile lifting bodies. This sensor suite must provide image data of sufficient sensitivity and resolution to detect ground vehicles, personnel, and low-flying aircraft at ranges up to 15km during both fair and limited visibility conditions. The sensor must be capable of operation from small, stationary lifting bodies with payload capacities less than 50 pounds. The sensor suite should operate day or night, in smoke and haze, and in rain with graceful degradation and not require more than .5 KVA of prime power. Additionally, this sensor suite must be designed with low-cost in mind. As a goal, the cost for 10 low rate initial production models should not cost more than $150K. It is envisioned that the innovative use of advanced composites, low-cost manufacturing techniques, and application of space based sensor technologies will be considered. There are currently no systems capable of meeting this need.
PHASE I: Design a prototype sensor suite with separable modules for the sensor head, data up/down link, signal processor, displays and controls. The prototype gear should have representative performance, but need not be form-factor. A report giving production weight and power budgets, performance estimates and a demonstration program plan is required.
PHASE II: Develop and integrate a prototype sensor with a GFE lifting body and ground mobility platform, i.e. HUMMWV, for a live demonstration program. Test the sensor suite and deployment mechanisms as a system, and provide a phenomenology and system performance report. A system description for a production item is also provided.

PHASE III DUAL USE APPLICATIONS: Lightweight imaging sensors have multiple applications as do the technologies to separate the signal processing, control and display functions. The immediate use of this technology is to support the recently formed Special Security Forces who will conduct surveillance, intelligence and security operations for US forces deployed overseas. Concurrently, this technology will be modeled by the US Army Mounted Warfare Battle Lab for concept development and force design analysis for potential use by its Cavalry and Scout units. Additionally the Marine Corps's Commandant's Warfighting Laboratory is interested in this technology for use in supporting Expeditionary Warfare Operations. Also, many commercial surveillance and security requirements could be addressed by these technologies. National border and coastline surveillance, as well as traffic management functions, could be enhanced by the application of such lightweight, low-cost, mobile systems.